

**B.Sc. DEGREE COURSE IN CHEMISTRY  
(SEMESTER PATTERN) (Final)**

**CHOICE BASED CREDIT SYSTEM (CBCS)**



**MOTHER TERESA WOMEN'S UNIVERSITY**

**KODAIKANAL – 624 101**

## REGULATIONS

### 1 . Objectives of the Course :

- A. To impart sound knowledge in fundamental aspects of all branches of Chemistry.
- B. To acquire basic knowledge in the specialized areas like Polymer Chemistry, Environmental Chemistry, Nano Chemistry, Pharmaceutical Chemistry etc.
- C. To motivate and create interest to continue higher studies in chemistry
- D. To equip student with skills for employment.

### 2. Condition for Admission

A candidate who has passed the Higher Secondary Examination of Tamil Nadu Higher Secondary Board or an examination of some other board accepted by the syndicate as equivalent shall be eligible for admission into B.Sc., course in Chemistry.

### 3. Duration of the Course:

The course for the degree of Bachelor of Science shall consist of three academic years divided into six semesters.

**Mother Teresa Women's University, Kodaikanal**

**B.Sc Chemistry**

P. No.	Paper Code	Course Title	Hours	Credits	Continuous Internal Assessment (CIS)	End Semester Exam (ESE)	Total
<b>Semester I</b>							
1.	ULTA11	Part-I- Tamil	6	3	25	75	100
2.	ULEN11	Part-II-English	6	3	25	75	100
3.	UCHT11	General Chemistry I	5	4	25	75	100
4.	UCHT12	General Chemistry II	5	4	25	75	100
5.	UCHA11	Allied Theory	5	4	25	75	100
6.	UVAE11	Value Education	3	3			100
<b>Total</b>			<b>30</b>	<b>21</b>			<b>600</b>
<b>Semester II</b>							
7.	ULTA22	Part I-Tamil	6	3	25	75	100
8.	ULEN22	Part II-English	6	3	25	75	100
9.	UCHT21	General Chemistry III	6	4	25	75	100
10.	UCHP21	practical I Volumetric analysis /Organic analysis and estimation	5	4	25	75	100
11.	UCHA21	<i>Allied Practical I</i>	5	4	25	75	100
12.	UEVS21	Environmental Studies	2	2	25	75	100
<b>Total</b>			<b>30</b>	<b>20</b>			<b>600</b>
<b>Semester III</b>							
13.	ULTA33	Part I-Tamil	6	3	25	75	100
14.	ULEN33	Part II- English	6	3	25	75	100
15.	UCHT31	Organic chemistry I	5	4	25	75	100
16.	UCHA32	Allied Theory II	5	4	25	75	100
17.	UCHE31	Elective I: Biochemistry	4	3	25	75	100
18.	UCHN31	Non Major Elective Course I	2	2	25	75	100
19.	UCHS31	Skill Based Studies I Water Treatment	2	2	25	75	100
<b>Total</b>			<b>30</b>	<b>21</b>			<b>700</b>
<b>Semester IV</b>							
20.	ULTA44	Part I-Tamil	6	3	25	75	100
21.	ULEN44	Part II-English	6	3	25	75	100
22.	UCHT41	Inorganic Chemistry -I	4	4	25	75	100
23.	UCHP42	Practical -II Inorganic Qualitative Analysis	4	4	25	75	100
24.	UCHA42	<i>Allied Practical II</i>	3	4	25	75	100
25.	UCHE42	Elective II	3	3	25	75	100

		Medicinal Chemistry					
26.	UCHN42	Non Major Elective course II	2	2	25	75	100
27.	UCHS42	Skill Based Studies II Clinical Chemistry	2	2	25	75	100
<b>Total</b>			<b>30</b>	<b>25</b>			<b>800</b>
<b>Semester V</b>							
28.	UCHT51	Organic Chemistry-II	5	4	25	75	100
29.	UCHT52	Inorganic Chemistry-II	5	4	25	75	100
30.	UCHT53	Physical Chemistry-I	5	4	25	75	100
31.	UCHT54	Analytical Chemistry	5	4	25	75	100
32.	UCHT55	Spectroscopy	5	4	25	75	100
33.	UCHE53	Elective III Polymer Chemistry	3	3	25	75	100
34.	UCHS53	Skill Based Studies III Every Day Chemistry	2	2	25	75	100
<b>Total</b>			<b>30</b>	<b>25</b>			<b>700</b>
<b>Semester VI</b>							
35.	UCHT61	Organic Chemistry -III	5	4	25	75	100
36.	UCHT62	Physical Chemistry -II	5	4	25	75	100
37.	UCHT63	Industrial Chemistry	5	4	25	75	100
38.	UCHP63	Practical IV Physical Chemistry	5	4	25	75	100
39.	UCHP64	Practical V Gravimetric Estimation and Organic Preparation	5	4	25	75	100
40.	UCHE64	Elective IV Nano Science and Technology	3	3	25	75	100
41.	UCHS64	Skill Based Studies IV Textile Chemistry	2	2	25	75	100
42.	UEAS61	Extension Activity	-	3	25	75	100
<b>Total</b>			<b>30</b>	<b>28</b>			<b>800</b>
<b>Total credits</b>				<b>140</b>		<b>Total</b>	<b>4200</b>

## SEMESTER I

UCHT11

GENERAL CHEMISTRY PAPER – I

5hours/4credits

### Objectives

1. To develop an understanding of both structure and chemical bonding of inorganic compounds.
2. To understand the tetravalency of carbon, displacement effects and reaction intermediates.
3. To understand the theory of atomic structure
4. To know the basic principles of behavior of gases

### UNIT - I

#### BASICS OF ORGANIC CHEMISTRY -I

- a) Introduction: Sources and classification of organic compounds, Geometry of hydrocarbons. Hybridization.
- b) Functional Groups: Definition – various functional groups – IUPAC – Nomenclature – Homologous series.
- c) Molecular weight determination of organic acids and bases.
- d) Problems to derive empirical and Molecular formula incorporating the estimation of elements and molecular weight calculations. Detection of elements - lassaigne's test.

### UNIT- II

#### BASICS OF ORGANIC CHEMISTRY -I

- a) Tetravalency of carbon atom
- b) Cleavage of bonds: Homolytic and heterolytic cleavages, bond energy, bond length and bond angle.
- c) Electron displacement effects: Inductive, electrometric, mesomeric, resonance, hyperconjugation and steric effects.
- d) Stability of Reaction Intermediates: Free radicals, carbonium and carbanion

## **UNIT- III**

### **PERIODICITY**

- a) Periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number.
- b) Horizontal, vertical and diagonal relationships in the periodic table, atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity; electronegativity-Pauling, Mulliken- Jaffe, Allred-Rochow definitions
- c) Oxidation states and variable valency; isoelectronic relationship; inert-pair effect. Atomic, molecular and equivalent weights; Avagadro's principle and mass-volume relationship.

## **UNIT - IV**

### **ATOMIC STRUCTURE**

- a) Bohr's theory, its limitations, Particle and wave character of electron, de Broglie's theory – equation, Davission – Germer experiment – photo electric effect – Compton effect, Heisenber's uncertainty principle – the Schrodinger equation derivation
- b) Postulates of quantum theory – quantum numbers and their significance
- c) Pauli's exclusion principle, atomic orbitals, shapes of orbitals, filling up of orbitals – Aufbau principle, (n+1) Hund's rule – Electronic configurations of the elements

## **UNIT - V**

### **GASEOUS STATE**

- a) Gaseous state: Ideal gas laws – deviations – limiting density of gases -van der Waal's equation – Equation of state – clausius, Berthelot and Dielectric – reduced equation of state and the law of corresponding state – Compressibility factor for gases – Boyle and inversion temperature of gases and their calculations Determination of van der Waal's constants.
- b) Critical phenomena of gases: PV isotherms of real and van der Waal's gases – critical state of gases. Definitions and determination of  $P_c$ ,  $V_c$ ,  $T_c$  – relation between van der Waal's constants.

### **Text Books**

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice- Hall Of India Limited, New Delhi, 1992.
2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

### **Reference Books**

1. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry, 4th ed., Harper Collins, New York, 1993.
2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6<sup>th</sup>ed., John Wiley, New York, 1999.
3. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi, 1996.
4. B.R. Puri and L.R. Sharma, Principles of physical chemistry, Shoban Lal Nagin Chand and Co. 33<sup>rd</sup>ed, 1992

## SEMESTER I

UCHT12

GENERAL CHEMISTRY PAPER II

5hours/4credits

### Objectives

1. To understand the basics of organic reactions, to know the chemistry of hydrocarbons.
2. To know the basic principles of metallurgy
3. To understand the chemistry of s-block elements
4. To know Kinetic theory of gas and concept of surface chemistry.

### UNIT – I

#### HYDROCARBONS -1

##### ALKANES

a) Preparation by Wurtz reaction, reduction or hydrogenation of alkenes, Corey-House method, petroleum refining

b) Reactions: Mechanism of halogenation, free radical substitution, sulphonation, nitration, oxidation, cracking and aromatisation.

##### ALKENES

c) General methods of preparation by dehydrogenation, dehydrohalogenation, dehydration, Hoffmann and Saytzeff rules, cis and trans eliminations.

### UNIT – II

#### HYDROCARBONS-2

##### ALKENES

a) Reactions of alkenes: Mechanism of electrophilic and free radical addition, addition of hydrogen, halogen, hydrogen halide (Markownikoff's rule), hydrogen bromide (peroxide effect), sulphuric acid, water, hydroboration, ozonolysis, dihydroxylation with  $\text{KMnO}_4$ , allylic bromination by NBS.

b) Stability of alkenes and dienes (conjugated, isolated and cumulative dienes).

##### ALKYNES

c) Preparation: Mechanism of dehydrohalogenation and dehydrogenation.

d) Reactions: Acidity of alkynes, formation of acetylides, Mechanism of addition of water, hydrogen halides and halogens, oxidation, ozonolysis and hydroboration/oxidation.



## **UNIT – III**

### **S-BLOCK ELEMENTS**

- a) General characteristics of s-block elements – comparative study of elements, alkali metals and their hydroxides, oxides and halides, alkaline earth metals and their oxides, carbonates and sulphates.
- b) Diagonal relationship of Li & Mg, Be & Al

## **UNIT – IV**

### **KINETIC THEORY OF GASES**

- a) Kinetic theory of gases – Maxwell Boltzmann law of distribution of molecular velocities – graphical representation – experimental verification of Maxwell velocity distribution
- b) root mean square- average and most probable velocities. Mean free path, collision number collision diameter.
- c) Viscosity of gases – Brownian movement and determination of Avogadro number - Loschmidt Number.

## **UNIT – V**

### **SURFACE CHEMISTRY**

- a) Catalysis, definition – characteristics – theories of catalysis promoters and poisons-enzyme catalysis - acid – bases catalysis and auto catalysis with suitable examples – applications.
- b) Adsorption – definition of the various terms – adsorption of gases on solids – characteristics of adsorption and chemisorption – factors influencing adsorption - adsorption isotherms – Freundlich and Langmuir adsorption isotherms – BET theory(no derivation) – elementary idea – application of adsorption.

### **Text Books**

- 1.R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall of India Limited, New Delhi, 1992.
2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

### **Reference Books**

1. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry, 4th ed., Harper Collins, New York, 1993.
2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6<sup>th</sup>ed., John Wiley, New York, 1999.

3. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi, 1996.

4. B. R. Puri and L. R. Sharma, Principles of physical chemistry, Shoban Lal Nagin Chand and Co. 33<sup>rd</sup>ed, 1992.

## SEMESTER II

UCHT21

GENERAL CHEMISTRY PAPER – III

5hours/4credits

### Objectives

1. To understand the basic properties and preparation of aliphatic halogen compounds
2. To understand the basic properties and preparation of hydroxy compounds
3. To understand the chemistry of boron and carbon
4. To know the concept of phase equilibria

### UNIT – I

#### ALIPHATIC HALOGEN COMPOUNDS

a) Nomenclature and classification

b) Preparation of aliphatic and aromatic halides: Free radical mechanism, addition and Substitution reactions.

c) Reactions: Nucleophilic substitutions,  $SN_1$ ,  $SN_2$  and  $SN_{Ar}$  mechanisms, stereochemistry and reactivity, effects of structure, substrate, solvent, nucleophile and leaving groups.

d) Eliminations:  $E_1$  and  $E_2$  mechanisms, evidences, orientations and stereochemistry.

### UNIT – II

#### HYDROXY COMPOUNDS

a) Aliphatic alcohols: Preparation by hydroboration, oxidation, Reduction of carbonyl compounds, epoxidation, Grignard synthesis and haloform reaction.

b) Phenols: Nomenclature, physical properties, hydrogen bonding.

c) Reactions: acidity, ether formation, ester formation, mechanism of ring substitution, nitration, sulphonation, halogenation, Friedel-Craft's reaction, nitrosation, coupling reactions, Kolbe's reaction and Reimer-Tiemen reaction.

### UNIT – III

#### BORON AND CARBON GROUP ELEMENTS

a) Group 13 (boron group): extraction of B and Si; types of compounds; reaction of B with other elements, water, air, acids, and alkali.

Compounds of boron with oxygen: boron sesquioxide, borazole, and borax.

b) Group 14 (carbon group): catenation and heterocatenation, allotropy of carbon-graphite, diamond, carbides-salt-like carbides, interstitial carbides, covalent carbides., silicates in technology-alkali silicates.

## **UNIT – IV**

### **PHASE EQUILIBRIA-I**

- a) Statement of significance of the terms involving derivation of phase rule.
- b) Application of phase rule to one-component systems. Water, Sulphur and Carbon dioxide.
- c) Application of phase rule to two component systems- Pb-Ag, Zn- Mg Condensed systems and reduced phase rule
- d) Solids in solids: simple eutectic with suitable examples, Compound formation with congruent and incongruent melting points with suitable examples.

## **UNIT – V**

### **PHASE EQUILIBRIA-2**

- a) Ideal solutions: Vapour pressure- Composition diagrams of solutions. Raoult's law, positive and negative deviations from the law. Principle of fractional distillation: Binary systems. Vapour diagram and azeotropic distillation, Variation of solubility with temperature – critical solution temperature (consolute temperature) lower, upper and critical solution temperature – influence of impurities on C.S.T. and applications.
- b) Solubility of gases in liquids; Henry's law, its relationship with Raoult's law.
- c) Lowering of vapour pressure: Thermodynamic derivation for elevation of boiling point and depression of freezing point. Relationship between osmotic pressure and vapour pressure. van Hoff's theory of dilute solutions.
- d) Distribution law: Thermodynamic derivation; limitation of the law, application in studying association, dissociation and solvation. Study of formation of complex ions. Extraction with solvents; efficiency of extraction.

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1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Prentice-Hall of India Limited, New Delhi, 1992.
2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

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2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, *Advanced Inorganic Chemistry*, 6<sup>th</sup>ed., John Wiley, New York, 1999.
3. B. R. Puri, L. R. Sharma, K. C. Kalia, *Principles of Inorganic Chemistry*, Shoban Lal Nagin Chand and Co., Delhi, 1996.
4. B. R. Puri and L. R. Sharma, *Principles of physical chemistry*, Shoban Lal Nagin Chand and Co. 3<sup>rd</sup>ed, 1992

## SEMESTER II

### PRACTICAL PAPER – I

**UCHP21      VOLUMETRIC AND ORGANIC ANALYSIS      5hours/4credits**

#### Objectives

1. To understand basics and gain knowledge on laboratory reagents and their uses in volumetric analysis.
2. To enable the students to acquire knowledge in Organic Estimation
3. To understand basics and gain knowledge in organic analysis
4. At the end of the course, the students should be able to plan experimental projects and execute them.

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard

Acidimetry and alkalimetry: Titration acids used: hydrochloric acid, sulphuric Standard solutions prepared: sodium carbonate, sodium bicarbonate, oxalic acid.

Oxidation and reduction titration: Oxidising agents: Potassium permanganate (permanganimetry) Reducing agents: Ferrous sulphate, ferrous ammonium Sulphate, oxalic acid

Standard solutions prepared: Ferrous Sulphate, ferrous ammonium Sulphate and oxalic acid.

Iodometry titrations: titrations of liberated iodine against sodium thiosulphate using acidified potassium permanganate, potassium dichromate and copper Sulphate solutions.

Standard solutions: potassium dichromate, copper sulphate.

## ORGANIC ESTIMATION AND ORGANIC ANALYSIS

### ORGANIC ESTIMATION

Estimation of aniline

Estimation of phenol

### ORGANIC ANALYSIS

Analysis of the organic substance containing the following functional groups:

Acids, phenols, aldehydes, ketones, esters, nitro compounds, amines, amides, anilides and halogenated hydrocarbons (side chain and nucleus ). Monosaccharide – glucose and fructose. Report should contain aromatic or aliphatic, saturated or unsaturated and a solid derivative or a colour reaction should be exhibited.

#### Text Books

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.

#### Reference Books

1. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.
2. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, 2003.
3. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2nd Edn., 2004.

### III SEMESTER

UCHT31

ORGANIC CHEMISTRY – PAPER I

5hours/4credits

#### Objectives

- 1.To understand the chemistry of stereoisomerism of organic molecules based on the spatial orientation of constituent atoms or group.
- 2.To understand the chemistry of aromatic compounds and substitution reaction and mechanism.
- 3.To understand the chemistry of carbonyl compounds
4. To understand the chemistry of polynuclear aromatic compounds and dyes.

#### UNIT – I

##### AROMATIC COMPOUNDS

- i)Introduction - general characteristic of aromatic compounds. Aromaticity and Huckel's rule – molecular orbital model of benzene.
- ii)Homologues of benzene: preparation, properties, and uses of toluene, xylene, mesitylene and styrene.
- iii)Aromatic substitutions:
  - a. Electrophilic, nucleophilic and free radicals substitution, explanations with examples.
  - b. Inductive effect, Electromeric effect, Resonance – Hyperconjugation, explanation with examples.

#### UNIT – II

- a)Mechanism of aromatic mono-substitution (electronic interpretation, nitration, sulphonation and Friedal-Craft's reaction.
- b)Isomerism in disubstituted benzene – Korner's absolute method of orientation relative methods,
- c)Directive influence of substituents – rules of distribution Vorlandor's method. Crum-Brown, Hammic and Illingwoth's rules.
- d)Electrophilic disubstitution – nucleophilic substitution unimolecular, bimolecular – benzyne mechanism – free and homolytic substitution in benzene.



### UNIT – III

Polynuclear hydrocarbons and their derivatives. Isolated systems: Naphthalene, Anthracene and Phenanthrene: preparation, properties uses and structure. Derivatives of Naphthalene – preparation, properties and uses of Naphthylamines, naphthols and naphthaquinones.

### UNIT – IV

#### STEREIOSOMERISM

a) isomerism of maleic and fumaric acids and aldoximes and ketoximes. Determination of configuration of geometrical Geometrical isomers – E-Z notation.

b) Optical isomerism:

- i) Optical activity – specific rotation and its polarimetric determination definition of optical isomers – elements of symmetry.
- ii) Optical isomerism of compounds containing asymmetric carbon atom and meso forms – racemisation and resolution of racemic mixtures – Walden inversion – asymmetric synthesis.
- iii) Optical activity of elements other carbon atoms. Quaternary ammonium compounds and tertiary amino oxides.

### UNIT – V

Dyes: Definition – theory of colour and constitution – classification of dyes according to structure and applications

- i) Azodyes – preparation of methyl orange, congo red and Bismark brown.
- ii) Triphenyl methane dyes – preparation of malachite green, Rosaniline and crystal violet.
- iii) Phthalein dyes – phenolphthalein, fluorescein and eosin – preparation, structure and properties.
- iv) Vat dyes – preparation and structure of Indigo.
- v) Anthraquinone dye – preparation and structure of alizarin.

#### Text Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall of India Limited, New Delhi, 1992.
2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

#### Reference Books

1. T. W. Graham Solomons, Organic Chemistry, 6th edition, John Wiley and sons, 1996.
2. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley and Sons, New York, 1992.
3. S. H. Pine, Organic Chemistry, 5th Edition, Mcgraw Hill International Edition, Chemistry Series, New York, 1987.
4. Sehan. N. Ege, Organic Chemistry, Structure and Reactivity, 3rd Edition, A.I.T.B.S., New Delhi, 1998.

## Objectives

1. To understand the handling of chemicals and errors in chemical analysis
2. To get knowledge in chemical bonding and hybridization
3. To acquire knowledge in volumetric analysis
4. To understand the basic concept of chemistry of biomolecules

## Unit 1: Handling of chemicals and Data analysis

- a) Storage and handling of chemicals: Handling of acids, ethers, toxic and poisonous chemicals. Antidotes, threshold vapour concentration and first aid procedure.
- b) Errors in chemical analysis: Accuracy, precision. Types of error-absolute and relative errors. Methods of eliminating and minimizing errors.
- c) Separation techniques–Solvent extraction. Principle of adsorption and partition chromatography, column chromatography, thin layer chromatography (TLC), paper chromatography and their applications.

## Unit 2: Chemical bonding

- a) Ionic Bond: Nature of Ionic bond. Structure of NaCl, KCl and CsCl. Factors influencing the formation of ionic bond.
- b) Covalent Bond: Nature of covalent bond. Structure of CH<sub>4</sub>, NH<sub>3</sub>, H<sub>2</sub>O based on hybridization.
- c) Coordinate Bond: Nature of coordinate bond. Coordination complexes. Werner's theory. Geometrical and optical isomerism in square planar and octahedral complexes. Mention of structure and functions of chlorophyll and hemoglobin
- d) Hydrogen Bond: Theory and importance of hydrogen bonding. Types of hydrogen bonding. Hydrogen bonding in carboxylic acids, alcohol, amides, polyamides, DNA and RNA.
- e) van der Waal's forces: Dipole – dipole and dipole - induced dipole interactions.

## Unit 3: Volumetric analysis

- a) Methods of expressing concentration: normality, molarity, molality, ppm.
- b) Primary and secondary standards: preparation of standard solutions
- c) Principle of volumetric analysis: end point and equivalence points.
- d) Strong and weak acids and bases - Ionic product of water , pH, pKa, pKb. Buffer solutions -  
pH of buffer solutions. Mention of Henderson equation & its significance.

#### **Unit 4: Kinetics**

- a) Chemical Kinetics: Rate, rate law, order and molecularity. Derivation of rate expressions for I and II order reactions.
- b) Catalysis-Homogeneous and heterogeneous catalysis. Enzyme catalysis, enzymes in biological system and in industry.

#### **Unit 5: Chemistry of biomolecules**

- a) Fats – Occurrence and composition. Hydrolysis of fats.
- b) Vitamins – Source, provitamin, properties and classification. Structure and function of vitamin A, C, D, K and E
- c) Hormones – Thyroxin, adrenaline and sex hormones (structure and functions only)

#### **Text Book**

1. R. Gopalan, S. Sundaram, *Allied Chemistry*, Sultan Chand and Sons, 1995.

#### **Reference Books**

1. U. Sathyanarayana, *Biochemistry*, Books and allied (p) Ltd, 1999.
2. B.R.Puri and L.R.Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co. 33rd ed., 1992.

**Objectives**

1. To understand the handling of chemicals and errors in chemical analysis
2. To get knowledge in chemical bonding and hybridization
3. To acquire knowledge in volumetric analysis
4. To understand the basic concept of chemistry of thermodynamics

**Unit 1: Handling of chemicals and Data analysis**

- a) Storage and handling of chemicals: Handling of acids, ethers, toxic and poisonous chemicals. Antidotes, threshold vapour concentration and first aid procedure.
- b) Errors in chemical analysis: Accuracy, precision. Types of error-absolute and relative errors. Methods of eliminating and minimizing errors.
- c) Separation techniques–Solvent extraction. Principle of adsorption and partition chromatography, column chromatography, thin layer chromatography (TLC), paper chromatography and their applications.

**Unit 2: Chemical bonding**

- a) Ionic Bond: Nature of Ionic bond. Structure of NaCl, KCl and CsCl. Factors influencing the formation of ionic bond.
- b) Covalent Bond: Nature of covalent bond. Structure of CH<sub>4</sub>, NH<sub>3</sub>, H<sub>2</sub>O based on hybridisation.
- c) Coordinate Bond: Nature of coordinate bond. Coordination complexes. Werner's theory. Geometrical and optical isomerism in square planar and octahedral complexes. Mention of structure and functions of chlorophyll and hemoglobin
- d) Hydrogen Bond: Theory and importance of hydrogen bonding. Types of hydrogen bonding. Hydrogen bonding in carboxylic acids, alcohol, amides, polyamides, DNA and RNA.
- e) van der Waal's forces: Dipole – dipole and dipole - induced dipole interactions.

**Unit 3: Volumetric analysis**

- a) Methods of expressing concentration: normality, molarity, molality, ppm.
- b) Primary and secondary standards: preparation of standard solutions
- c) Principle of volumetric analysis: end point and equivalence points.
- d) Strong and weak acids and bases - Ionic product of water , pH, pKa, pKb. Buffer solutions -  
pH of buffer solutions. Mention of Henderson equation & its significance.

#### **Unit 4: Kinetics**

- a) Chemical Kinetics: Rate, rate law, order and molecularity. Derivation of rate expressions for I and II order reactions.
- b) Catalysis-Homogeneous and heterogeneous catalysis. Enzyme catalysis, enzymes in biological system and in industry.

#### **Unit-5: Thermodynamics**

- a) Introduction: Scope and importance of thermodynamics- system and surrounding-isolated, closed and open systems- state of the system- intensive and extensive variables. Thermodynamic process- reversible and irreversible, isothermal and adiabatic process-
- b) First law of thermodynamics- statement- definition of internal energy (E), enthalpy (H), applications of first law of thermodynamics.  
The second law of thermodynamics: Limitations of first law and the need for the second law, different ways of stating II law and its significance, Spontaneous or irreversible process.  
The concept of entropy – definition and physical significance of entropy.

#### **Text Book**

1. R. Gopalan, S. Sundaram, *Allied Chemistry*, Sultan Chand and Sons, 1995.

#### **Reference Books**

1. U. Sathyanarayana, *Biochemistry*, Books and allied (p) Ltd, 1999.
2. B.R.Puri and L.R.Sharma, *Principles of physical chemistry*, Shoban Lal Nagin Chand and Co. 33rd ed., 1992.

## **SEMESTER III**

### **ELECTIVE PAPER – I**

**UCHE31**

**BIOCHEMISTRY**

**4hours/3credits**

#### **Objectives**

1. To enable the student to develop a sound knowledge of fundamental concepts in biochemistry.
2. To emphasis on the various aspects of lipids and proteins
3. To understand the classification and properties of nucleic acid, amino acid and hormones.
4. To emphasis on the various aspects of metabolism and interrelationship of metabolic events.

#### **UNIT – I**

##### **LIPIDS**

- a) Introduction- Classification - neutral lipids, Phospho lipids (lecithines, cephalins, plasmalogens) and glycolcoipids.
- b) Fatty acids – saturated, unsaturated fatty acids, Properties – Hydrolysis-acid number, saponification number.
- c) Cholesterol – biosynthesis. Bile salts derived from cholesterol.
- d) Metabolism: biosynthesis of lipids – synthesis of fatty acids and synthesis of triglycerides.

#### **UNIT –II**

##### **PROTEINS**

- a) Introduction-polypeptide chains- classification – properties-3D structure-denaturation and renaturation of protein molecules- biological functions
- b) Separation and purification of proteins – dialysis – gel filtration – electrophoresis

#### **UNIT – III**

##### **AMINO ACIDS**

- a) Introduction-classification –properties-structure – biological functions.
- b) Synthesis of -amino acids and their identification.

## **UNIT – IV**

### **NUCLEIC ACIDS**

- a) Nucleosides and nucleotides – purine and pyrimidine bases.
- b) DNA – Occurrence – chemical composition – double helix structure – RNA – Chemical composition – transfer RNA – Biological functions of DNA & RNA

## **UNIT – V**

### **HARMONES**

- a) Introduction-Vertebrate hormones – classification – Testosterone – progesterone – Insulin
- b) Biosynthesis – metabolism – functions.

### **Text Book**

1. Lehninger, Principles of Biochemistry, Fourth Edition, by David L. Nelson and Michael M. Cox, Worth Publishers, New York, 2005.

### **Reference Books**

- 1. L. Veerakumari, Biochemistry, MJP publishers, Chennai, 2004.
- 2. Lubert Stryer, Biochemistry, W. H. Freeman and company, New York, 1975.

## SEMESTER -III

### APPLIED CHEMISTRY – PAPER I NON – MAJOR ELECTIVE

UCHN31

2hours/2credits

#### Objective

- 1.To understand the preparation and properties of Rubber and Fibers
2. To understand the preparation and properties of Plastics and Resins.
3. To know the classification and importance of Fertilizers
4. To understand the use of chemicals in improvement of agricultural crops

#### UNIT – I

Rubber – natural and synthetic rubbers, composition of natural rubber, neoprene rubber, styrene butadiene rubber (SBR).

#### UNIT – II

Fibers – definition, natural and synthetic fibers.

#### UNIT – III

Resins – natural and synthetic resins – distinction between resins and plastics.

#### UNIT – IV

Plastics – classification, properties, Bakelite, Urea, Formaldehyde, Teflon, Nylon-66, and Dacron.

#### UNIT –V

Fertilizers – definition, classification, urea, super phosphate, potassium nitrate, mixed fertilizer.

#### Text Books

- 1.Norris shreve, R. and Joseph A. Brink, J. Chemical process industries, 4th ed.; Mc Graw – Hill Kogakusha, ltd: 1977.
2. George T. Austin. Shreve’s chemical process industries, 5th ed.; Mc Graw – Hill: 1984.

#### Reference Books

1. Subba rao, N. S. Biofertilizers in agriculture; oxford and IBH publishing co.: New Delhi, 1982.



2. Jain, P. C. and Jain, M. Engineering chemistry, 10th ed.; Dhanpat Rai and sons: Delhi, 1993
3. Kamaraj, P.; Jeyalakshmi, R. and Narayanan, V. Chemistry in engineering and technology; sudhandhira publications: chennai, 2001.

## SEMESTER-III

### SKILL BASED SUBJECT– PAPER I

UCHS31

WATER TREATMENT

2hours/2credits

#### Objective

1. To give an in-depth understanding of water quality parameters, ground water and surface water pollution and its control measures.
2. In addition, the students will also learn the water treatment methods, sewage and industrial effluent treatment methods and water resources management.
3. To understand the pollutants and their effect on environment and on human health
4. To know the basic information of water treatment methods for domestic and industrial purposes

#### UNIT –I

Uses of water – safe and wholesome water – sources of water supply: Rain: hydrological cycle, acid rain, artificial rain, rain water harvesting. Surface water: impounding reservoir, river and tanks – their characteristics and impurities. Ground water; wells and springs. Water borne diseases/substances affecting the potability of water.

#### UNIT – II

Effects of impurities in natural waters: colour taste and odour, turbidity and sediment and micro organism. Dissolved mineral matter – hardness types – estimation (EDTA method) – methods of softening – boiling, addition of lime – addition of sodium carbonate – ion exchange method.

#### UNIT – III

Clarification of water: sedimentation and filtration. Coagulation of water electrochemical coagulation – flocculants – sterilization and disinfection of water: chemical methods and physical methods.

#### UNIT- IV

Demineralization of water – ion exchange process – desalination of sea water: electro dialysis method, reverse osmosis methods.

Water analysis: physical examination – chemical examination bacteriological examination – BOD, COD.

#### UNIT – V

Miscellaneous methods of water treatment: color, odour and taste removal – iron and manganese removal – fluoridation – defluoridation, prevention of plumb solvency – removal of slime and algae from water - de- oxygenation of water.

### **Text Books**

- 1.Environmental Chemistry by B.K. Sharma and H. Kaur, Goel Publishing House.1996.
- 2.Environmental Chemistry, A. K. De, 5th Edn., New Age International Publisher, 2005.
- 3.Environmental Chemistry, B. K. Sharma, 11th Edn., Krishna Prakashan media Limited, 2007

### **Reference Books**

1. Chemical and Biological Methods for Water Pollution Studies, R.K. Trivedy and P.K. Goel, Environmental Publications, 1986.
2. Engineering Chemistry, P.C. Jain and Monica Jain, Dhanpat Rai and Sons, 1993.
- 3.Water Quality and Defluoridation Techniques, Rajiv Gandhi National Drinking Water Mission Publication, 1994.

## SEMESTER IV

UCHT41

INORGANIC CHEMISTRY PAPER – I

4hours/4credits

### Objectives

1. To know the arrangement of elements in the periodic table group 15 and group 17
2. To identify the nature of chemical bond in a given inorganic compound.
3. To know the existence of special types of compounds through weak chemical forces.
4. To know the concept of solid state structure and metallurgy

### UNIT-I

#### GROUP-15 (NITROGEN GROUP) & GROUP-17 (HALOGENS)

- a) Metallic and nonmetallic character of group 15 elements; hydrides and halides of group 15 elements, hydrazine, hydroxylamine, phosphines
- b) Oxides of N and P: oxides of nitrogen-dinitrogen tetroxide, phosphorous pentoxide, Properties and uses of phosphites and phosphates; phosphate fertilizers.
- c) Group-17 (halogens): anomalous behavior of F, ionic-, covalent-, bridging halides, reactivity of halogens, Oxoacids of halogens: hypohalous acid HOX, halous acid HXO<sub>2</sub>, halic oxide HXO<sub>3</sub>, perhalic acid HXO<sub>4</sub>, strength of oxoacids.
- d) Interhalogen compounds: ClF<sub>3</sub>, BrF<sub>3</sub>, IF<sub>3</sub>; IF<sub>5</sub>: Structure (only)- VSEPR Model.

### UNIT – II

#### IONIC BONDING

- a) Properties of ionic compounds, energetics of formation of ionic compounds, Lattice energy: Born-Landé equation, Born-Haber's cycle
- b) Covalent character of ionic compounds-Fajan's rules, solubility, melting points, and thermal stability of typical ionic compounds.

### UNIT – III

#### COVALENT BONDING

- a) Lewis theory-Octet rule and its exception, electron dot structural formula, Sidgwick-Powell theory-prediction of molecular shapes

b) Valence Bond theory-arrangement of electrons in molecules. Hybridization( $sp^3$ ,  $sp^2$ ,  $sp$ ,  $sp^3d$  and  $sp^3d^2$  with suitable examples) and geometry of molecules. VSEPR theory- Effect of bonding and nonbonding electrons on the structure of molecules

c) MO theory: MO diagram for simple homonuclear molecules - carbon, nitrogen, oxygen, chlorine and Heteroatomic molecules -hydrogen chloride – Bond order and stability, comparison between valence bond and molecular orbital method.

## **UNIT – IV**

### **METALLIC BONDING AND WEAK CHEMICAL FORCES**

a) Metallic bond: Metallic properties, band theory of metals; semiconductors: n- and p-type semiconductors.

b) Weak forces: Hydrogen bonding-intra- and intermolecular hydrogen bonding, influence on the physical properties of molecules, van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions.

## **UNIT -V**

### **SOLID STATE STRUCTURE AND METALLURGY**

a) Classification of solids- Isotropic and anisotropic crystals- elements of symmetry, seven crystal systems, Miller indices, space lattice and unit cell.

b) X-ray diffraction- derivation of Bragg's equation Structures of NaCl, CsCl and ZnS.

c) Metallurgy : Occurrence of metals – concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, aluminothermic process, purification of metals – electrolysis, zone refining, Van Arkel de-Boer process.

### **Text Book**

1. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry, 4th ed., Harper Collins, New York, 1993.

### **Reference Books**

1. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6<sup>th</sup> ed., John Wiley, New York, 1999.

2. T. Moeller, Inorganic Chemistry: A Modern Introduction, Wiley, New York, 1990.

3. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry , Shoban Lal Nagin Chand and Co., Delhi, 1996.

## SEMESTER IV

### PRACTICAL PAPER II

**UCHP42                      INORGANIC QUALITATIVE ANALYSIS                      4hours/4credits**

#### **Objectives**

1. To enable the students to develop analytical skills in inorganic qualitative analysis.
2. To appreciate the various colored chemical reactions of metal ions.
3. To acquire skills in inorganic quantitative estimation methods
4. To get trained in quantitative estimation methods, and to gain knowledge in the preparation of some inorganic complexes

Mixture containing two acid radicals of which one is interfering ion and two basic radicals.

Acid radicals: Chloride, Bromide, Iodide, Sulphate, Nitrate, Carbonate, Fluoride, Phosphate, Borate, Oxalate.

Basic radicals: Lead, Copper, Cadmium, Bismuth, Antimony, Ferrous, Ferric, Aluminium, Zinc, Calcium, Nickel, Manganese, Cobalt, Barium, Strontium, Magnesium, ammonium.

#### **Text Book**

1. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd edition, The National Publishing Company, Chennai, 1974.

#### **Reference Book**

1. Vogel's Text Book of Inorganic Qualitative Analysis, 4th edition, ELBS, London, 1974.

## IV SEMESTER – PAPER II

### VOLUMETRIC ANALYSIS

UCHA42    ANCILLARY CHEMISTRY –BOTANY/PHYSICS    5hours/4credits

#### Objectives

1. To understand basics and gain knowledge on laboratory reagents and their uses in volumetric analysis.
2. To enable the students to acquire knowledge in Organic Estimation
3. To understand basics and gain knowledge in organic analysis
4. At the end of the course, the students should be able to plan experimental projects and execute them.

#### I. Acidimetry and alklimetry

- a. Titration between a strong acid against NaOH
- b. Titration between a strong acid against  $\text{Na}_2\text{CO}_3$
- c. Titration between sodium hydroxide against oxalic acid

#### II. Permanganometry

- a. Titration between  $\text{KMnO}_4$  against oxalic acid
- b. Titration between  $\text{KMnO}_4$  against ferrous sulphate
- c. Titration between  $\text{KMnO}_4$  against Mohr's salt (Ferrous ammonium sulphate)

#### III. Iodometry:

- a. Titration between sodium thiosulphate and potassium dichromate
- b. Titration between sodium thiosulphate and copper sulphate

#### Text Books

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.

#### Reference Books

1. N.S. Ganapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.
2. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, 2003.



3. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2nd Edn., 2004.

## **SEMESTER IV**

### **ELECTIVE PAPER – II**

**UCHE42**

**MEDICINAL CHEMISTRY**

**3hours/3credits**

#### **Objectives**

1. To understand the basic concepts and strategies in drug design and synthesis.
2. To provide preliminary introduction to vitamins and their classification
3. To provide preliminary introduction to sulpha drugs and antimalarial activity.
4. To provide preliminary knowledge on Anesthetics drugs, antibiotics and their synthesis.

#### **UNIT – I**

##### **INTRODUCTION AND IMPORTANCE OF CHEMISTRY IN PHARMACY**

Important terminologies used their meaning – molecular pharmacology – pharmacodynamics, pharmacophore – metabolites, antimetabolites – drugs – definition – important drugs dosage – Indian medicinal plants and trees.

#### **UNIT – II**

##### **VITAMINS**

Definition – classification – source, therapeutic uses and deficiency of vitamin A, vitamin B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, vitamin D, vitamin E and K.

#### **UNIT – III**

##### **SULPHA DRUGS, ANTIMALARIALS**

Sulpha drugs \_ sulphadiazine. Prontosil, prontosil – S – antimalarials, quinine, plasmoquine

.

#### **UNIT – IV**

##### **ANESTHETICS**

Definition – transport of anaesthetics – halogenated hydrocarbons – chloroform – ethylchloride – trichloroethylene – gaseous anesthetics – cyclopropane and nitrous oxide – local anesthetics, classification, characteristics – benzocaine, piperocaine and lidocaine.

## **UNIT – V**

### **ANTIBIOTICS**

Definition – pencillins, teracyclins, teramycin, streptomycin and chloromycetin.

#### **Text Book**

1. Jayashree Ghosh, A Text book of Pharmaceutical Chemistry, S. Chand & Co., New Delhi, 2009.

#### **Reference Book**

2. Ashutosh Kar, Medicinal Chemistry, New Age International Publisher, New Delhi, 3rd Edn., 2006.

## SEMESTER IV

### APPLIED CHEMISTRY - PAPER II

UCHN42

NON-MAJOR ELECTIVE

2hours/2credits

#### Objectives

1. The generation of energy from various types of fuels.
2. To gain knowledge in silicate industry, match industry
3. Pollution occurring from various sources and resulting toxic effects
4. To acquire basic knowledge in Explosives

#### UNIT – I

Match Industry – Raw materials – manufacturing process, pyrotechnics coloured smokes.

#### UNIT – II

Explosives – definition classification, Nitroglycerine, dynamite cordite, TNT and Picric acid.

#### UNIT – III

Silicate Industry – Cement and Glass, Raw materials and manufacture of cement and glass.

#### UNIT – IV

Petrochemicals – definition, origin, composition chemicals from natural gas, petroleum, light naphtha and kerosene, LPG.

#### UNIT – V

Photography – colour photography.

#### Text Books

1. Norris Shreve, R. and Joseph A. Chemical process industries, 4th ed.; Mc Graw – Hill Kogakusha, ltd: 1977.
2. George T. Austin. Shreve's chemical process industries, 5th ed.; Mc Graw – Hill: 1984.

#### Reference Books

1. Subba Rao, N. S. Biofertilizers in agriculture; oxford and IBH publishing co.: New delhi, 1982.
2. Jain, P. C. and Jain, M. Engineering chemistry, 10th ed.; Dhanpat Rai and sons: Delhi, 1993
3. Kamaraj, P.; Jeyalakshmi, R. and Narayanan, V. Chemistry in engineering and technology; Sudhandhira publications: chennai, 2001.
4. Kuriakose, J. C. and Rajaram, J. Chemistry in engineering and technology. Vol 2.; Tata Mc Graw Hill: New Delhi, 1988.
5. De, A.K. Environmental chemistry 2nd ed.; Wiley Eastern Ltd., 1987.

## SEMESTER IV

### SKILL BASED SUBJECT– PAPER II

UCHS42

CLINICAL CHEMISTRY

2hours/2credits

#### Objectives

1. To understand the basics of blood and composition
2. To impart knowledge on clinical biochemistry and laboratory practices.
3. To understand the normal and abnormal constituents of urine
4. To gain the clinical demonstration of Blood grouping, Rh factor, Blood Glucose and Hb content

#### UNIT –I

Blood – composition and their role in health and disease, blood grouping, Rh factor, Blood pH.

#### UNIT–II

Electrolytic balance, function of plasma proteins, Albumin – Globulin ratio, clotting mechanism, blood pressure, coagulant and anticoagulant.

#### UNIT –III

Blood lipid, arteriosclerosis, lipid profile, blood sugar, blood glucose and its regulation, glucose tolerance test (GTT).

#### UNIT –IV

Urine – normal and abnormal constituents of urine, renal function test.

#### UNIT –V

Only demonstration

- a. Blood grouping
- b. Rh factor
- c. Blood Glucose
- d. Hb content

#### Text Book

1. Practical Clinical Biochemistry: Methods and Interpretations, R. Chawla, 3rd Edn., Jaypee Brothers Medical Publishers, New Delhi, 2003.

**Reference Book**

1. Fundamentals of Practical Clinical Biochemistry, B. Mohanty and S. Basu, B. I. publishers, New Delhi, 2006.

## V SEMESTER

UCHT51

ORGANIC CHEMISTRY – PAPER II

5hours/4credits

### Objectives

1. To develop an understanding the chemistry of carbohydrates.
2. To understand the chemistry of aliphatic acids, aromatic acids, nitrogen compounds and their derivatives.
3. To understand the chemistry of carboxylic acid and their derivatives
4. To develop an understanding the chemistry of amines and quaternary ammonium salt.

### UNIT – I

#### a) Aliphatic acids

- i) Resonance of carboxylate ion-relative strengths of carboxylic acids.
- ii) Halogen substituted acids. Preparation and properties of monochloro. Dichloro and trichloro acetic acids. The overall reactivity of halogen and the influence of halogen atom on the strength of acids.
- iii) Amino acids: Preparation and properties of glycine, alanine and phenyl alanine. Action of heat on  $\alpha$ ,  $\beta$ , and  $\gamma$  amino acids.
- iv) Dicarboxylic acids
  - i) Saturated acid, preparation and properties of malonic acid – Malonic ester, its synthetic uses – succinic, glutaric and Adipic acids – rule.
  - ii) Unsaturated acid: Preparation and properties of maleic and fumaric acids.

### UNIT –II

#### Aromatic acids

- i) Benzoic and Toluic acids. Effect of substituent on acidic characters.
- ii) Substituted benzoic acid – salicylic and anthranilic acids – preparation And properties.
- iii) Dicarboxylic acids – preparation and properties of phthalic acid, isophthalic acid and terephthalic acids. Derivatives of phthalic acid-phthalic anhydride and phthalimide.
- iv) Sidechain carboxylic acids: Preparation and properties of phenylacetic acid, mandelic acid and cinnamic acid – coumarin.
- v) Acid derivatives – synthesis and reactions of acid halides, amides, Anhydrides and esters.

### UNIT – III

#### Alicyclic Compound

General method of preparation and properties of cycloparaffins – Baeyer's Strain theory and its modifications. Conformational analysis – Fischer's plane Projection formula – Newmann's projection formula and Sawhorse formula of ethane, 1,2 Cyclic ketones – Civetone and muscone.



## UNIT – IV

### Nitrogen Compounds

#### Aliphatic nitrogen compounds

- i. Cyanides and isocyanides – General method of preparation And properties – Distinction between ethylcyanide and isocyanide.
  - ii. Alkyl nitrites and nitro alkanes – General method of preparation and properties – Distinction between ethyl nitrite and nitroethane – tautomerism in nitro compounds.
  - iii. Amines: Classification – Quaternary ammonium compounds – Basic character of amines. Aliphatic diazo compounds – preparation, properties and Structure of diazomethane and diazoacetic ester.
- Iv. Derivatives of carbonic acid
- a. Manufacture, properties, structure and uses of urea – Estimation of urea.
  - b. Aromatic amino compounds – preparation and properties of isomers of toluidines – estimation of amine.

## UNIT – V

### CARBOHYDRATES

- a. Monosaccharides – detailed study of glucose and fructose – structure and configuration – mutarotation and epimerization – Interconversion glucose And fructose – Descent and ascent of the sugar series – Estimation of Glucose.
- b. Disaccharides – structure and properties of sucrose.
- c. Polysaccharides – structure of starch and cellulose – applications of cellulose derivatives.

### Text Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992.
2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

### Reference Books

1. T. W. Graham Solomons, Organic Chemistry, 6th edition, John Wiley and sons, 1996.
2. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley and Sons, New York, 1992.
3. S. H. Pine, Organic Chemistry, 5th Edition, Mc Graw Hill International Edition, Chemistry Series, New York, 1987.
4. Sehan. N. Ege, Organic Chemistry, Structure And Reactivity, 3rd Edition, A.I.T.B.S., New Delhi, 1998.

## SEMESTER – V

UCHT52

INORGANIC CHEMISTRY PAPER II

5hours/4credits

### Objectives

1. To understand the nature of bonding in coordination compounds.
2. To understand the importance and application of coordination compounds in industry and in medicine.
3. To understand the active roles played by metal ions and coordination compounds in biological systems.
4. To understand the concept of nuclear chemistry and radiation chemistry

### UNIT - I

#### COORDINATION CHEMISTRY I

- a) Introduction - Types of ligands: unidentate, bidentate and polydentate ligands, chelating ligands and chelates- IUPAC nomenclature of coordination compounds.
- b) Isomerism in coordination compounds: Structural isomerism, hydrate isomerism, coordination isomerism, ionisation isomerism, linkage isomerism, coordination position isomerism.
- c) Stereoisomerism: Geometrical isomerism of four and six coordinate complexes, optical isomerism of four and six coordinate complexes.
- d) Werner and Sidgwick theories, methods of detecting complex formation

### UNIT –II

#### COORDINATION CHEMISTRY II

- a) **Theories of coordination compounds** : Valence bond theory, limitations of valence bond theory, crystal field theory – splitting of d orbitals in octahedral, tetrahedral and square planar fields, CFSE, factors affecting CFSE, colour, geometry and magnetic properties of coordination compounds, Jahn – Teller distortion (an elementary idea).
- b) **Synthesis of Coordination Compounds**: *Cis*- and *trans*-effects in synthesis of square planar and octahedral complexes.

### UNIT-III

#### a) BIOINORGANIC CHEMISTRY

Role of metal ions biological systems – metallo porphyrins , porphyrins – chlorophyll, heme proteins - hemoglobin and myoglobin, vitamin B12 (structure only)

#### b) ACIDS AND BASES

Modern concept of acids and bases – Arrhenius, Bronsted – Lewis concept – Usanovich concept – introduction to non-aqueous solvents – leveling effect – differentiating solvent – reactions in liquid ammonia in detail.

## **UNIT IV**

### **NUCLEAR CHEMISTRY AND RADIATION CHEMISTRY**

a) The nucleus: subatomic particles, structure of the nucleus-forces in the nucleus-mesons; stability of nucleus-n/p ratio, mass defect & binding energy; radioactive elements. Factors affecting stability of nucleus-binding energy per nucleon, n/p ratio, magic number, odd-even rule, nuclear models – liquid drop and shell models, isobars, isotones and isomers.

b) Natural and induced radioactivity; radioactive decay; neutron emission, positron emission, electron capture; unit of radioactivity (Curie); half life period; Geiger- Nuttal rule, radioactive displacement law, radioactive series. Measurement of radioactivity: ionization chamber, Geiger counters, scintillation counters..

c) Applications: energy tapping, dating of objects, neutron activation analysis, isotopic labeling studies, nuclear medicine-<sup>99m</sup>Tc radiopharmaceuticals.

Hazards of radiations

## **UNIT – V**

### **NUCLEAR REACTIONS**

a) Nuclear reactions: types of nuclear reactions, nuclear cross section, spallation Nuclear fission and fusion: Theories of fission, application of fission and the principle of atom bomb – nuclear fusion and emission of energy, stellar energy and Hydrogen bomb. nuclear reactors- fast breeder reactors, fuels used in nuclear reactors, moderators, coolants;

b) Particle accelerators: Linear accelerator cyclotron and synchrotron.

### **Text Books**

1. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry, 4th ed., Harper Collins, New York, 1993.

2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, 6<sup>th</sup> ed., John Wiley, New York, 1999.

### **Reference Books**

1. T. Moeller, Inorganic Chemistry: A Modern Introduction, Wiley, New York, 1990.

2. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi, 1996.

## SEMESTER V

UCHT53 PHYSICAL CHEMISTRY PAPER –I

5hours/4credits

### Objective

1. To understand basic principles of thermodynamics
2. To understand the application of thermodynamics
3. To impart the knowledge of understand and application of first, second and third law of thermodynamics.
4. To understand the basic principle of chemical kinetics and its applications;

### UNIT – I

#### Thermodynamics – I

Introduction: Scope and importance of thermodynamics – energy and its units – mechanical work and heat and their relation – thermodynamic systems and their characteristics – state of a system – state function and path function and their characteristics – thermodynamic functions – exact and inexact differentials.

First Law: Statement – mathematical formulation – change in constant pressure –  $C_p-C_v$  relationship – work done in isothermal, reversible expansion and compression of an ideal gas – Calculation of  $E$ ,  $H$  and  $w$  for adiabatic reversible expansion. Reversible isothermal expansion of a real gas – calculation of  $E$ ,  $q$ ,  $w$  and  $H$  for a van der waal's gas – Joule-Thomson effect ( $\Delta E/\Delta V$ ) $T$  value for ideal gas – temperature, calculation and significance.

### UNIT – II

#### Thermodynamics – II

Variation of enthalpies with temperature – Kirchoff's equation – Hess's law of constant heat summation – statement and applications.

Bond enthalpies – definition – calculation from the thermo chemical data and applications.

Zeroth law of thermodynamics and its significance.

#### Thermodynamics – II

II law of thermodynamics - object of the II law – different ways of stating II law and its significance. Conversion of heat into work – Carnot's theorem and cycle – Thermodynamic efficiency – thermodynamic scale of temperature.

### UNIT – III

#### Thermodynamics – III

Entropy – definition and significance the concept of entropy – entropy changes in isolated systems – entropy as a thermodynamic function dependence of entropy on variables of the system.

Entropy changes in ideal gas, in mixing of gases, physical transformations and in chemical reactions. Entropy and probability

Free energy functions: Helmholtz free energy ( $A$ ) – definition and temperature dependence – Gibb's free energy with temperature and pressure – Gibb's-Helmholtz equation and its applications – Maxwell's relations.

#### **UNIT – IV**

Partial molar quantities: chemical potential – relationship between partial molar quantities – Gibb's Duhem equation – chemical potential in case of a system of ideal gases – application of the concept of chemical potential – Clausius-Claypeyron equation – derivation and its applications.

Thermodynamics – III

Nernst heat theorem and its application - Third law of thermodynamics – a simple treatment of the law. Temperature dependence of heat capacity and its use in the determination of absolute entropy. Exceptions to III law – residual entropy of  $\text{CO}$ ,  $\text{N}_2\text{O}$ ,  $\text{H}_2\text{O}$ ,  $\text{NO}$  and  $\text{H}_2$

#### **UNIT – V**

**CHEMICAL KINETICS:**

Rate of a reaction – rate law and rate constant – order and molecularity of a reaction.

Reactions of first order and pseudo first order reaction – derivation of rate constant and half life period – catalytic decomposition of hydrogen peroxide, conversion of N-chloro acetanilide to p-chloro acetanilide, decomposition of dinitro pentoxide – hydrolysis of ester by acids – inversion of canesugar.

Reaction of II order: derivation of rate constant and half-life period – saponification of ester.

Reactions of III order: derivation of rate constant and half-life period. Reaction between  $\text{FeCl}_3$  and  $\text{SnCl}_2$ .

Methods of determining the order of reactions.

Reactions of zero order surface reactions – derivation of rate law – specific examples.

Influence of temperature on the rate of a reaction – Arrhenius rate equation and its significance – measurement of Arrhenius parameters,  $A$  and  $E_a$ .

Theory of reaction rates – Collision theory – unimolecular reactions – Lindemann – Theory of absolute reaction rates.

#### **Text Books**

1. S.H. Maron and J.B. Lando, Fundamentals of Physical Chemistry, Macmillan limited, New York, 1966.
2. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin chand and Co. 33rd edition, 1992.

#### **Reference Books**

1. P.W. Atkins, Physical Chemistry, 7th edition, Oxford university press, 2001.
2. S.K. Dogra and S. Dogra, Physical Chemistry Through Problems, New age international, 4th edition 1996.
3. Gilbert. W. Castellan, Physical Chemistry, Narosa publishing house, third edition 1985.
4. Irving M. Klotz and Robert M. Rosenberg, Chemical Thermodynamics, John Wiley and sons, Inc. 1994.

5. J. Rajaram and J.C. Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and CO. 1986.
6. K. L. Kapoor, A Textbook of Physical chemistry, (volume-2 and 3) Macmillan, India Ltd, 1994.

## SEMESTER – V

UCHT54

ANALYTICAL CHEMISTRY

5hours/4credits

### Objectives

1. To understand laboratory safety measures and error analysis
2. To emphasize the basic principles of different electroanalytical techniques,
3. To learn the basic principles, instrumentation and applications of spectrochemical, thermal and techniques
4. To know the basic principles and applications of separation techniques.

### UNIT- I

#### HANDLING OF CHEMICALS AND ANALYSIS

##### a) Safety and hygiene in the Chemistry Lab

Storage and handling of chemicals, handling of acids, ethers, toxic and poisonous chemicals, antidotes, threshold vapour concentration and first aid procedure. Heating methods, stirring methods filtration techniques. Calibration of pipette, standard measuring flask and burette. Weighing principle in chemical balance and single pan balance

**b) Errors:** Definition – terms- absolute and relative error – precision and accuracy – Methods of expressing precision: mean, median, deviation, average deviation and coefficient of variation -classification of errors - t-test rejection of experimental data – Q-test sources and elimination of errors or Minimizing errors -Significant figures and its application with respect to the glassware used. Normal error curve and its importance

### UNIT-II

#### PURIFICATION TECHNIQUES

##### a) Chromatography

Definition of Chromatography, mobile phase and stationary phase. Classification of Chromatography. Principle of adsorption and partition chromatography.

**b) Column chromatography:** requirement of a good adsorbent- solid stationary phase-liquid stationary phase, adsorbents, classification of adsorbents, solvents, preparation of column, applications.

**c) Thin Layer Chromatography:** choice of adsorbent, choice of solvent, preparation of chromatogram, preparation of plate, developing chambers, development of plate,  $R_f$  value, applications.

**d) Paper chromatography:** types of paper used, various method of development (ascending, descending and radial) solvent used,  $R_f$  value, factors which affect  $R_f$  value. Separation of amino acids by paper chromatography – TLC is superior to other methods of chromatography.

### **UNIT-III**

#### **SOLUBILITY EQUILIBRIA**

##### **a) General Separation Techniques**

Solubility and solubility products, expressions for solubility products. Determination of solubility from solubility products.

##### **b) Precipitation titrations**

Argentometric titrations, indicators for precipitation titrations involving silver. Determination of chloride by Volhard's method. Adsorption indicators.

##### **c) Gravimetric methods of analysis**

Separation by precipitation, factors affecting solubility, gravimetric factor. Purity of precipitates, von Weiman ratio. Co-precipitation, post precipitation. Precipitation from homogenous solution.

### **UNIT –IV**

#### **TITRIMETRIC METHODS OF ANALYSIS**

##### **a) General Introduction**

General principle. Types of titrations. Requirements for titrimetric analysis. Concentration systems: Molarity, formality, normality, wt% ppm, milliequivalence and millimoles-problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point

##### **b) Acid-base Equilibria**

pH of strong and weak acid solutions. Buffer solutions. Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from  $K_a$  and  $K_b$  values. Neutralisation- titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange.

##### **c) Complexometric titrations**

Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics.

### **UNIT-V**

#### **ATOMIC ABSORPTION SPECTROSCOPY**

Introduction, Instrumentation source, burner, flame, monochromators, Detectors, Double beam Absorption Spectrometer, Interference, Applications.

#### **THERMAL ANALYSIS**

Thermal analytical methods, principle involved in thermogravimetric analysis and differential gravimetric analysis, discussion of various components with block diagram, characteristics of TG and DTA, Factors affecting TG and DTA curves.

#### **POLAROGRAPHY**

Introduction—migration current-diffusion current-residual current-polarogram- Instrumentation-advantages of DME-Ilkovic equation (no derivation)- Applications.



### **Text Books**

1. D.A. Skoog, D.M. West and F.J. Holler, Analytical Chemistry: An Introduction, 5th edition, Saunders college publishing, Philadelphia, 1990.
2. U.N. Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 1995.

### **Reference Books**

1. R.A. Day Jr. A.L. Underwood, Quantitatives Analysis, 5th edition, Prentice Hall of India Private Ltd., New Delhi, 1988.
2. Elementary Organic Spectroscopy: Principles and Chemical Applications, S.Chand and company Ltd., Ram Nagar, New Delhi, 1990.
3. V.K. Srivastava, K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S. Chand and company, New Delhi, 1987.
4. R.M. Roberts, J.C. Gilbert, L.B. Rodewald, A.S. Wingrove, Modern Experimental Organic Chemistry, 4th edition, Holt Saunders international editions.
5. A.K. Srivastava, P.C. Jain, Chemical Analysis: An Instrumental Approach for B.Sc. Hons. and M.Sc. Classes, S. Chand and company Ltd., Ram Nagar, New Delhi.

## SEMESTER V

UCHT55

SPECTROSCOPY

5hours/4credits

### Objectives

1. To gain the basic knowledge of microwave spectroscopy
2. To impart the knowledge of UV-vis spectroscopy, to familiarize with the calculation of absorption maximum.
3. To impart knowledge of infrared and Raman spectroscopies, to gain expertise of assigning experimental values to the different vibrations.
4. To understand the basis of NMR spectroscopy and solving simple organic molecules, to impart basic knowledge of mass spectrometry

### UNIT – I

#### INTRODUCTION AND MICROWAVE SPECTROSCOPY

Regions of electromagnetic spectrum – parameters of electromagnetic radiation – molecular spectroscopy – Born-Oppenheimer approximation - Electronic, vibrational and rotational energy levels, and transitions in atoms and molecules. Absorption and emission spectra  
Microwave spectroscopy – rotational spectra of diatomic molecules (rigid rotors), frequency separation – determination of moment of inertia and bond length.

### UNIT – II

#### IR SPECTROSCOPY

Principle – types of stretching and bending vibrations. vibrational frequency – factors influencing vibrational frequencies – instrumentation, fingerprint region, study of hydrogen bond. Raman spectroscopy – Rayleigh and Raman scattering – stokes and anti-stokes lines. Comparison of Raman and IR spectroscopy- Mutual exclusion principle, applications

### UNIT – III

#### ELECTRONIC SPECTROSCOPY

Beer –Lambert's law, Types of electronic transitions, chromophore, auxochrome, absorption maximum ( $\lambda_{\max}$ ) and intensity of absorption bands, factors influencing  $\lambda_{\max}$  and intensity - instrumentation of UV-Visible spectrophotometer, Frank-Condon principle

### UNIT – IV

#### NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Principle, basic instrumentation, shielding mechanism, chemical shift, multiplicity, spin-spin coupling and coupling constants.

## **UNIT – V**

### **MASS SPECTROSCOPY**

Principle, molecular ion peak, base peak, isotopic peak, metastable peak fragmentation – nitrogen rule. Mass spectrum of simple organic compounds (acetaldehyde, ethyl alcohol, methyl amine and toluene).

### **Text Books**

1. Elementary Organic Spectroscopy: Principles and Chemical Applications, S.Chand and company Ltd., Ram Nagar, New Delhi, 1990.
2. V.K. Srivastava and K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S. Chand and company, New Delhi, 1987.

### **Reference Books**

1. R.M. Roberts, J.C. Gilbert, L.B. Rodewald, and A.S. Wingrove, Modern Experimental Organic Chemistry, 4th edition, Holt Saunders international editions.
2. A.K. Srivastava and P.C. Jain, Chemical Analysis: An Instrumental Approach for B.Sc. Hons. and M.Sc. Classes, S. Chand and company Ltd., Ram Nagar, New Delhi.

## SEMESTER V

### ELECTIVE PAPER – III

UCHE53

POLYMER CHEMISTRY

3hours/3credits

#### Objectives

1. To understand the importance of polymers and an exposure to polymer chemistry
2. To understand various polymer and characterization of polymers
3. To enable a student to understand polymer structures and properties
4. To know the basic importance of molecular weight determination of polymer

#### UNIT – I

Introduction – Monomers, Oligomers, Polymers and their characteristics-Degree of polymerization- Functionality of polymer-Classification of polymers-addition polymers – PVC, orlon

Condensation polymers – Definition, Dacron, Nylon 6-Nylon 6,6 – preparation properties, uses – copolymers – preparation, properties and uses of saron.

Bonding in polymers : Primary and secondary bond forces in polymers

Mechanism of addition polymerization – free radical polymerization – ionic polymerization.

#### UNIT – II

Thermoplastics and thermosetting polymers.

Thermoplastics : Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester.

Thermosetting Plastics : Phenol formaldehyde and epoxide resin

#### UNIT – III

Elastomers or Rubber – natural rubber – compounding of rubber, properties, uses, synthetic rubbers – buna-s neoprene, silicone rubber.

Conducting Polymers, examples : poly sulphur nitriles, poly phenylene, polypyrrole and poly acetylene.

#### UNIT – IV

Molecular weight determination – number average, weight average methods of determination – osmotic pressure, viscosity, light scattering methods.

## **UNIT –V**

Inorganic polymers – introduction – general properties – glass transition temperature classification – preparation, properties and uses of Boron Nitride, silicone rubber.

### **Text Books**

1. G.S. Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited, 1996.
2. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971.

### **Reference Books**

1. A. Kumar and S. K. Gupta, Fundamentals and Polymer Science and Engineering, Tata McGraw-Hill, 1978.
2. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, Polymer Science, Wiley Eastern Ltd., New Delhi, 1978.
3. Sharma, B.K., Polymer Chemistry, Goel Publishing House, Meerut, 1989.
4. Arora M.G., Singh M. and Yadav M.S., Polymer Chemistry, 2nd Revised edition, Anmol Publications Private Ltd., New Delhi, 1989.

## SEMESTER V

### SKILL BASED SUBJECT – III

UCHS53

EVERYDAY CHEMISTRY

2hours/2credits

#### Objectives

1. To understand the basic knowledge in Food Chemistry and modern trends in the industry.
2. To create awareness among the undergraduate students about the role of chemistry in day- to- day life
3. To know more about the cosmetics and other chemicals that they uses
4. To obtain adequate knowledge and scientific information regarding basic principles of everyday chemistry.

#### UNIT – I

Dairy chemistry milk – definition – general composition of milk – constituents of milk lipids, proteins, carbohydrates, vitamins and minerals. Physical properties of milk – colour, odour, acidity, specific gravity, viscosity and conductivity. Factors affecting the composition of milk – pasteurization, homogenization, toning, standardization, reconstitution of milk - adulteration of milk.

#### UNIT – II

Mineral metabolism: calcium – source, daily requirement, blood calcium, hypocalcemia, phosphorus – functions of phosphate, requirement, source, normal serum level, functions. Sodium – normal level of sodium, excretion of sodium, restriction of sodium in diet, hypernatremia.

#### UNIT – III

Preparation of tooth powder, paste, talcum powder, shampoo, handkerchief perfumers, dry perfume sachets, soap powder, diswashing powder, various soaps, toilet cleaning liquids.

#### UNIT – IV

Wax products – candles, boot polish, furniture polish paste.

Ink – blue, red, blue black, white board marker, printing ink, ink for stamp pad.

## UNIT – V

Safety matches – agarbathies naphthalene balls – chalk crayons – insecticides such as lice killer, mosquito repellent, cockroach terminator, moth repellent. Simple medicines: pain balm, digestive tablet, disinfectant solutions

### Text Books

1. Swaminathan M. Advanced Text Book on Food and Nutrition , volume I and II Printing and Publishing CO., Ltd., Bangalore. 1993.
2. Swaminathan M. Text Book on Food chemistry, Printing and Publishing CO., Ltd., Bangalore. 1993.
3. Norman N. Potter , Food science, CBS publishers and distributors, New Delhi. 1994.
4. Lillian Hoagland Meyer, Food Chemistry, CBS publishers and distributors, New Delhi. 1994.

### Reference Books

1. Owen R Fennema, Food Chemistry, Marcel Decker Inc., New York. 1996.
2. Srilakshmi B., Food Science, New age International Pvt. Ltd. Publishers, III ed. 2003.
3. Siva Sankar B., Food Processing and Preservation. Prentice – Hall of India Pvt. Ltd., New Delhi. 2002.
4. Ramakrishnan S., Prasannam K.G and Rajan R –Principles. Text book of medical biochemistry. Orient Longman Ltd. III ed. 2001.
5. Shakuntala Manay N. and Shadaksharaswamy M. FOODS: Facts and Principles. New age International Pvt. Ltd. Publishers, II ed. 2002

## VI SEMESTER

UCHT61

ORGANIC CHEMISTRY PAPER – III

5hours/4credits

### Objectives

1. To understand the basic concept of organic spectroscopy
2. To understand the concept of tautomerism and free radicals
3. To learn and practice the molecular rearrangements and the reaction mechanisms.
4. To learn the basic aspects of heterocyclic compounds and natural products.

### UNIT – I

a) Application of spectroscopy to organic molecules – theory and applications of spectroscopic methods – electromagnetic spectrum – the UV spectrum – I identification of conjugation – Woodward Fieser Rule – adsorption maxima.

b) IR Spectrum – functional group detection, finger print region – study in Hydrogen bonds.

c) NMR Spectrum – no of signals – equivalent and non-equivalent protons- chemical shift – peak area and proton counting – splitting of signals – spin-spin coupling.

### UNIT – II

a) Tautomerism: Definition – condition of Tautomerism – prototropy and Anisotropy – types of Tautomerism.

- i) Keto – enol tautomerism
- ii) Nitro-acinitro tautomerism
- iii) Nitro-isonitro tautomerism
- iv) Lactam – lactim tautomerism and
- v) Quinone monoxime – p-nitrophenol

b) FREE RADICALS: Definition – preparation and reactions of short lived and long lived free radical – stability of free radicals – Role of free radicals in Chain reaction. Organic photochemistry – [photochemical reactions of olefins, Cis–trans isomerism and dimerisation.

### UNIT – III

MOLECULAR REARRANGEMENTS: Detailed mechanisms of the following reactions, Pinacol – Pinacolone, Hofmann Curtius, Benzilic acid, Claisen, Benzidine, Beckmann, Fries and Wagner – Meerwing rearrangements.



## UNIT – IV

Heterocyclic compounds containing one hetero atom. Preparation and properties, structure of pyrrole, furan, thiophene, indole, pyridine, quinoline, and isoquinoline.

## UNIT – V

a)Alkaloids: Definition, occurrence, extraction of alkaloids and general methods for determining the structure of alkaloids – Classification of alkaloids - structure and synthesis of the following alkaloids : Cocaine, papaverine, piperine and nicotine.

b)Terpenoids: Introduction, classification occurrence, isolation – general properties – isoprene rule – General methods of determining structure, Synthesis – properties – structures of citral, geraniol, terpenol.

### Text Books

- 1.R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992.
2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

### Reference Books

1. T. W. Graham Solomons, Organic Chemistry, 6th edition, John Wiley and sons, 1996.
2. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley And Sons, New York, 1992.
3. S. H. Pine, Organic Chemistry, 5th Edition, Mcgraw Hill International Edition, Chemistry Series, New York, 1987.
4. Sehan. N. Ege, Organic Chemistry, Structure And Reactivity, 3rd Edition, A.I.T.B.S., New Delhi, 1998.

## SEMESTER VI

UCHT62

PHYSICAL CHEMISTRY PAPER – II

5hours/4credits

### Objectives

1. To understand and theory of photochemistry
2. To understand basic terminologies of electrochemistry,
3. To know the theories of strong electrolytes, to be familiar with the fundamentals of different types of electrochemical cells
4. To understand the basic of primary and secondary cells

### UNIT – I

Photochemistry: Photochemical reactions – definition – comparative study of thermal and photochemical reactions – laws of photochemistry: Lambert and Beer's laws, Grotthus – Drapper law, Stark-Einstein law – quantum efficiency and its determination – consequences of light.

Absorption by atoms and molecules – photophysical processes- fluorescence, phosphorescence and other deactivating processes. Jablonskii diagram.

Photochemical processes: Kinetics of photochemical reactions.

- i) Gaseous reactions: Hydrogen-chlorine reaction, decomposition of HBr, HI and photolysis of ammonia.
- ii) Reactions in liquid phase (solutions) – isomeric transformation of maleic to fumaric acid – polymerization of anthracene.
- iii) Photochemical equilibrium – flash photolysis – photosensitization – chemiluminescence.
- iv) Radiation chemistry – application

### UNIT – II

#### ELECTROCHEMISTRY – I

Conductance:

Definition and determination – specific, equivalent conductance with dilution and its limiting values.

Strong and weak electrolytes: theory of strong electrolytes – Debye-Huckel-Onsager equation (no derivation) ionic activity and activity co-efficient

Ostwald's dilution law and its applications

Kohlrausch's law of ionic mobilities and its applications.

Absolute velocity of ions and its determination – Transport number of ions and their determination.

Applications of conductivity measurements – degree of dissociation – solubility of a sparingly soluble salt – degree of hydrolysis – basicity of acids – conductometric titrations.

## UNIT – III

### ELECTRO CHEMISTRY –II

Ionic Equilibria:

- a) Common ion effect and solubility product – quantitative study and their applications.

Hydrolysis – degree of hydrolysis ( $\alpha$ ) – hydrolysis constant ( $K_h$ ) – their experimental determination and derivation of these values for different salt solutions – based on  $K_w$ ,  $K_a$  and  $K_b$  calculation involving hydrolytic constants. pH of solutions – definition and methods of determination of pH

Buffer solution - definition – theory of buffer action and applications – Henderson equation.

## UNIT – IV

### ELECTROCHEMISTRY – III

Electrode potentials and electrochemical cells.

Single electrode potentials – oxidation and reduction potentials

Thermodynamics and electromotive force (emf) – relation between chemical and electrical energies – calculation of  $\Delta G$ ,  $\Delta S$ , and  $\Delta H$  of cell reaction. Calculation of emf. Nernst equation – standard electrode potential and its characteristics.

Types of electrodes: metal – metal ion, gas, metal – insoluble salt, redox, glass electrodes.

Chemical and voltaic cells: Definition – cell reaction and representations of electrodes and cells – emf of cell – conventions regarding signs of emf – calculation of cell emf from single electrode potentials. Calculation of cell emf with the aid of Nernst equation. Experimental determination of emf of cells. Measurement of single electrode potentials – chemical cells with and without transference – liquid junction potential and salt bridge.

Concentration cells: Definition and calculation of emf – types of concentration cells – concentration cells with and without transference – determination of activity coefficient of electrolytes.

## UNIT – V

Commercial cells: Primary and secondary cells – Weston Cadmium cell, lead storage cell, Ni-Cd cell, fuel cell.

- a) Applications of emf measurements.
- b) Determination of solubility and solubility product of sparingly soluble salts.
- c) Determination of pH – using Hydrogen electrode, glass electrode, quinhydrone electrode.
- d) Determination of valency of ion.
- e) Potentiometer titrations – acid-base, redox, precipitation and complexometric titrations.
- f) Determination of transport number.

Electrolysis and polarization: Over voltage, decomposition potential, hydrogen over voltage.

### **Text Books**

1. S.H. Maron and J.B. Lando, Fundamentals of physical chemistry, Macmillan limited, New York, 1966.
2. B.R. Puri and L.R. Sharma, Principles of physical chemistry, Shoban Lal Nagin Chand and Co. 33rd edition, 1992.

### **Reference Books**

1. S.K. Dogra and S. Dogra, Physical chemistry through problems, New age international, 4th edition 1996.
2. Gilbert. W. Castellan, Physical chemistry, Narosa publishing house, third edition 1985.
3. P.W. Atkins, Physical chemistry, Oxford university press, 1978.
4. K. L. Kapoor, A textbook of Physical chemistry, (volume-2 and 3) Macmillan, India Ltd, 1994.

## SEMESTER VI

UCHT63

INDUSTRIAL CHEMISTRY

5hours/4credits

### Objectives

1. The generation of energy from various types of fuels.
2. Use of chemicals in improvement of agricultural crops
3. To gain knowledge in silicate industry, match industry
4. To acquire basic knowledge in corrosion and prevention

### UNIT – I

- a) Fertilizers: Definition - Nutrients for plants – Role of various elements in plant growth – natural and chemical fertilizers – classification of chemical fertilizers – Urea, super phosphate and potassium nitrate – Mixed fertilizer – Fertilizer Industry in India.
- b) Match Industry, pyrotechny and explosives: Raw materials needed for match industry – manufacturing process – pyrotechnics – coloured smokes – Explosives; Definition – classification – Nitroglycerine, dynamite, cordite, TNT and picric acid.

### UNIT – II

- a) Silicate Industry: Cement, Glass and ceramics. Raw materials and manufacture of cement, Glass and ceramics.
- b) Petrochemicals: Elementary study – Definition – origin – composition – chemicals from natural gas, petroleum, Light Naphtha and Kerosene – synthetic gas.

### UNIT –III

- a) Corrosion of metals: Definition – various methods of preventing corrosion – coating with other metals (galvanizing, lining, and electroplating ) – cathodic protection and painting – corrosion inhibitors.
- b) Photography: Colour photography

### UNIT – IV

Chemistry of paper Industry: Raw materials manufacturing process – bleaching and colorings.

### UNIT – V

#### PAINTS:

Manufacture – setting – characteristics of good paint, failure, varnish – types.

### **Text Books**

1. Norris shreve, R. and Joseph A. Chemical process industries, 4th ed.; Mc Graw – Hill Kogakusha, ltd: 1977.
2. George T. Austin. Shreve's chemical process industries, 5th ed.; Mc Graw – Hill: 1984.

### **Reference Books**

1. Subba rao, N. S. Biofertilizers in agriculture; oxford and IBH publishing co.: New delhi, 1982.
2. Jain, P. C. and Jain, M. Engineering chemistry, 10th ed.; Dhanpat Rai and sons: delhi, 1993

**VI SEMESTER**  
**PHYSICAL CHEMISTRY EXPERIMENTS**

**UCHP63**

**PRACTICAL PAPER – IV**

**5hours/4credits**

**Objectives**

1. To enable the students to acquire knowledge in physical chemistry experiments
  2. To learn the applications of colligative properties, to carry out experiments based on phase rule,
  3. To acquire skills based on chemical kinetics experiments and to understand electrochemistry through experiments.
  4. To learn the titration between acid and base
- 
- Determination of  $K_f$  of a solute by Rast method (cryoscopy)
  - Determination of molecular weight of a solute by Rast method
  - Simple eutectic phase diagram, Compound formation
  - Determination of CST of phenol-water system study of effect of impurities on CST
  - Determination of Partition coefficient of iodine in  $CCl_4$  and water system
  - Determination of equilibrium constant of  $KI+I_2 \rightleftharpoons KI_3$  system. Determination of strength of potassium iodide
  - Determination of rate constant of a first order reaction -ester hydrolysis
  - Comparison of strengths of two acids by ester hydrolysis method
  - Conductivity titration between an acid and a base

**Text Book**

1. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987.

**Reference Books**

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
2. David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, Experiments in Physical Chemistry, 5th Edi., McGraw- Hill Book company, 1989.

## SEMESTER – VI

### PRACTICAL PAPER –V

UCHP64

#### GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATION

5hours/4credits

#### Objectives

1. To enable the students to acquire the quantitative skills in gravimetric analysis and preparative skills in inorganic preparations
2. To acquire practical knowledge of estimation of inorganic compounds
3. To develop skill in single stage preparation of organic compounds
4. To understand the basic concept of preparation of solutions

#### GRAVIMETRIC ANALYSIS

Estimation of Ca as calcium oxalate monohydrate

Estimation of Ba as chromate

Estimation of Lead as Chromate

#### ORGANIC PREPARATION:

Preparation involving

Hydrolysis – Ester hydrolysis

Amide hydrolysis

Benzoylation of beta naphthol amines

Acetylation of an amine

Nitration of acetanilide

Oxidation: Benzoic acid from benzaldehyde

#### Text Book

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt., 1996.

#### Reference Book

1. Vogel's Text Book of Quantitative Chemical Analysis. 5th Edi., ELBS/Longman England, 1989.



## ELECTIVE PAPER IV

UCHE64

NANO SCIENCE AND TECHNOLOGY

3hours/3credits

### Objectives

1. To introduce some of the fundamentals and current state-of-the-art in nanotechnology.
2. To get familiarized with the synthesis, characterization and applications of nanomaterials.
3. To understand the basic concept of preparation of nanotubes
4. To acquire knowledge in importance of nanomaterials in medicine

### UNIT-I

Introduction – nanochemistry, nanotechnology, nanoproperties, nanotubes, nanowires characterization – application -fullerenes – purification -properties -optical properties.

### UNIT-II

Carbon nanotubes – synthesis and purification -filling of nanotubes mechanism of growth – transport properties – mechanical properties – physical properties – application of carbon nanotubes.

### UNIT-III

Core-shell nanoparticles -types of system – properties – application of core shell nanoparticles – monolayer protected metal nanoparticles method of preparation – functional metal nano particles – applications.

### UNIT- IV

Nanosensors – nanoscale organization for sensors – nanosensors on optical properties – physical properties – nanobiosensors – sensors of the future nanoshells – types of nanoshells – properties -applications.

### UNIT-V

Nanomedicines – various kinds of nano system in use – protocols for nanodrug – administration – nanotechnology in diagnostic application. Use of gold nano- particles in diagnostic and therapeutic application molecular nanomechines -covalent and non covalent approaches molecular motors and machines – molecular devices – practical problems with molecular devices.

### **Text Book**

1. T. Pradeep, Nano: The Essentials: Understanding Nanoscience and Nanotechnology, McGraw-Hill Professional Publishing, 2008.

### **Reference Book**

1. J. Dutta, H.F. Tibbals and G.L. Hornyak, Introduction to Nanoscience, CRC press, Boca Raton, 2008.

## SEMESTER-VI

### TEXTILE CHEMISTRY

UCHS64

SKILL BASED SUBJECT PAPER – IV

2hours/2credits

#### Objective

1. To facilitate the students to learn about the pre-treatments of various kinds of textile materials involved in textile wet processing industries.
2. To acquire knowledge of natural fibres
3. To get basic importance of dyeing process
4. To understand the basic concept of printing methods

#### UNIT – I

Natural Fibre: properties of textile fibres – classification of fibres. Natural fibres of vegetable origin – chemical and physical properties of cotton, jute. Natural fibres of animal origin: chemical and physical properties of wool and silk – natural mineral fibres: chemical and physical properties of asbestos and glass.

#### UNIT – II

Man made fibre: mode of production – types of spinning – wet dry and melt spinning.

- a. viscose rayon: Raw material, method of conversion to fibre and filament form. Physical and chemical properties and uses.
- b. Cuprammonium rayon and cellulose acetate: raw materials, method of conversion to fibre and filament form. Physical and chemical properties and uses.
- c. Synthetic organic fibre: polyamide and polyester fibre – raw materials, method of production, physical and chemical properties fibre structure.

#### UNIT – III

Pre – treatment process for dyeing:

Study of operation, principles and different agent for singeing, desizing, scouring and bleaching.

#### UNIT – IV

Dyeing: classification of dyes – theories of dyeing

Direct dye: properties, method of application to cotton – assistants used and their functions.

Sulphur dye: properties, method of application to cotton. Acid dye: properties, method of application to cotton.

Vat dye: properties, method of application to cotton.

## **UNIT – V**

Printing: different methods of printing like hand block printing, stencil printing, wax printing, screen printing, roller printing etc.

### **Text Book**

1.Venkatraman.K., “The Chemistry of Synthetic Dyes” – Vol. I & II, Academic press, London, 1990 .

### **Reference Book**

1. David. R. Waring, Geoffrey Hallas, The Chemistry and Application of Dyes, SDC,1990